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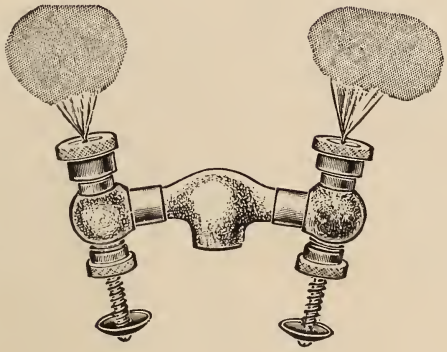
THE SPRAYING OF PLANTS.



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MAINE

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THE SPRAYING OF PLANTS.

W. M. Munson.

LET US SPRAY.

"It is conservatively estimated that the annual yield of all crops is lessened about 25 per cent. by the attacks of injurious insects and fungous diseases. Experiments have demonstrated that at least 75 per cent. of this loss can be prevented by the use of simple remedies applied by means of a spray pump. Expressed in figures, the annual loss would represent about $500,000,000 in the United States alone. Of this amount, 75 per cent., or $375,000,000 can be saved by spraying."*

The above paragraph represents the facts concerning the importance of spraying, at the present time. Previous reports † have detailed the experiments made along this line at this Station, and equally striking results have been obtained at other stations. Spraying has ceased to be an experiment. The beneficial results obtained at the experiment stations have been fully corroborated in practical field work, and now it is important to know the *how* and the *why* of spraying. In other words, in order that the best results may be obtained, spraying must be done intelligently.

Success in spraying, as in most of the work in life, is largely a matter of detail. Little things, seemingly unimportant, all affect the results obtained. Failure may usually be attributed to lateness of application, carelessness in applying or in preparing the material, or to defective apparatus.

WHY SPRAY?

Spraying is plant insurance. It is, with few exceptions, a *preventive* measure for many of the ills that plants are heir to, and *not* a cure. There are several distinct classes of enemies

* Weed, Spraying for Profit, p. 9.

† Rep. Maine Expt. Sta., 1891, p. 99; 1892, p. 92; 1893, p. 124.

that must be met, each in a different way. These enemies may be grouped first under the two general heads,—insects and fungi.

The insect enemies are naturally divided into distinct classes which must be met in very different ways, and the same is true of the fungi. The first class of insect enemies includes those that, either in the mature form or as larvæ, eat the plant tissue; e. g., the plum curculio, the codling moth, the currant worm, the tent-caterpillar, the potato beetle, etc. These are very readily destroyed by the application of some form of arsenic, as Paris green, to the parts which will be eaten.

Another class of insects, e. g., the plant lice and some of the scale insects, obtain their food by sucking the juices of the plant and, therefore, are not affected by an application of poison. These must be overcome by an external irritant, such as kerosene, or an alkali like caustic soda or strong soap suds, or by some material that will close the breathing pores and thus stop respiration, e. g. pyrethrum or hellebore (in the dry form hellebore acts in both ways).

Fungi (singular, *fungus*) are simply low forms of plant life which feed upon organic matter, either living or dead. Those which grow on living tissues—*parasitic fungi*—are the ones with which we are specially concerned. It is these which cause many of the blights and rusts, and smuts and scabs and mildews of various plants. Fungi are propagated by means of minute, microscopic bodies, called spores, which are carried from place to place by the wind and by insects, birds and other animals. A spore, falling upon the surface of a leaf, or the growing tip of a branch, if in the presence of moisture and the usual summer temperature, germinates in a manner very similar to that of a seed. If the surface of the leaf or fruit is coated with some material which is destructive to the young fungus, as the spore germinates, all the damage from the parasite is warded off. If, on the other hand, there is even a small spot that is not coated, there is opportunity for the parasite to obtain a foothold. With few exceptions, after the parasite has once attacked the plant, spraying is of little if any avail.

WHEN TO SPRAY.

The time of spraying will depend upon the purpose in view, but in *no case* should spraying be done when the plants are in full bloom. Spraying at this time will often interfere with the fertilization of the flowers, and consequently reduce the crop of fruit, while there is much needless destruction of bees and other insects which work upon the flowers.

In general, spray *early*. "Delays are dangerous." Fruit trees should be sprayed before the buds open, potatoes before disease or insects appear. Subsequent treatment will depend very largely upon the nature of the season; if very wet, it may be necessary to spray every two or three weeks; if relatively dry, three or four treatments may be sufficient.*

HOW TO SPRAY.

Insecticides and fungicides are more effective if applied in a liquid rather than in a dry form, since they adhere to the foliage better. *Sprinkling is not spraying.* The best results are obtained from the use of a fine spray or mist forcibly applied to the foliage; and so far as possible, it should reach the under sides of the leaves. A fine mist is preferable to a coarse spray, as there is much less waste of material and much less danger of injury to the foliage. A single dash of the mist is better than continued soaking, as in the latter case the material gathers in drops and runs off or injures the foliage.

As already stated, spraying for fungi is a preventive measure rather than a cure. If the surface of the leaf is not completely covered on both sides, with the protective coating, there is still danger of attack. The spores of the fungus may fall upon the smallest unprotected spot.

Again, while young insects may be killed by a very small dose of poison, a much larger amount will be required as they grow older. So spraying should be commenced early, that the first meal of a young insect may be his last, and in order to insure this end, the poison must be finely divided and evenly distributed.

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*The Station has prepared specific directions for spraying; (1) Apples and other fruit trees; (2) potatoes. These will be sent free to any address upon application.

THE MATERIALS FOR SPRAYING.

The materials used in spraying are mainly of two general kinds, fungicides used in killing fungi, and insecticides, used in killing insects. The principal fungicides are Bordeaux mixture and sulphide of potassium. The more important insecticides are arsenic, in some form (usually Paris green), kerosene and tobacco.

*Bordeaux Mixture.** This is the fungicide *par excellence* for general use, and its preparation is a matter of considerable importance. The formula in general use at present is known as the "4, 4, 40" formula. In other words the mixture consists of 4 lbs. copper sulphate, 4 lbs. fresh lime and 40 gallons of water. The copper sulphate should be dissolved in three or four gallons of water in a wooden or earthen vessel and the lime (which must be absolutely fresh) should be slaked in a separate vessel, and diluted with water till it is of a milky nature. When ready for use, the two solutions may be mixed in a third vessel, care being taken to stir constantly during the process. In every case, the mixture should be passed through a sieve of number 50 brass wire cloth, or through cheese cloth backed by common window screen wire. This straining is necessary to prevent clogging of the nozzle.

Potassium Sulphide. Potassium sulphide, or "liver of sulphur" is specially valuable as a preventive of gooseberry mildew and for use in the greenhouse. In using this material four ounces of the sulphide are dissolved in ten gallons of water.

Paris Green. This material is the one which is always reliable for the destruction of leaf-eating insects. Many other forms of arsenic have been recommended, but none have proved so generally satisfactory as Paris green.† It is practically insolu-

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* More specific directions for the preparation of Bordeaux mixture will be found in the special directions for spraying, already referred to. While the use of freshly prepared Bordeaux is to be preferred, there are "prepared" Bordeaux mixtures that are used by some who doubt their ability to make the mixture. These prepared mixtures may be obtained from most dealers in spraying apparatus. The two brands which have come to the notice of the writer are the "Lenox" made by the Lenox Sprayer Company, Pittsfield, Mass., and the "Lion," made by James A. Blanchard, New York City.

† Among the cheaper substitutes for Paris green are "Green Arsenite," "Paragrene," "Emerald Green," "Arsenite of Soda," "Arsenate of Lead," etc. With the exception of the last named, which is largely used by the Gypsy Moth Commission of Massachusetts, the substitutes are still to be considered as experimental.

ble in water, but as there is usually present a small amount of soluble arsenic, it is always well to add a little fresh lime to the mixture before applying, that injury to the foliage may be averted. Paris green is generally mixed with water in the proportion of 1 pound to 200 gallons. If lime is added, however, a pound to 100 gallons may be used.

Kerosene. Kerosene is the specific for all sucking insects. It kills by contact and, owing to its cheapness and efficiency, will probably remain the most valuable insecticide for this class of insects. The form in which it is usually applied is the soap emulsion,* but there are now several forms of spray pumps which make a mechanical mixture of kerosene and water, thus greatly reducing the labor.

Tobacco. A strong decoction of tobacco ("tobacco tea") is often used with success in destroying the lice upon rose bushes and tender, soft-wooded plants.

WHAT APPARATUS IS NECESSARY?

In order that the best results may be obtained, suitable apparatus is needed. Such apparatus consists of a good force-pump, with one or two lines of discharge hose, nozzles, a barrel or tank for holding the mixture and a wagon for carrying all.

The Pump. The pump should be large enough to supply two lines of discharge pipe, so that one man may pump while two others distribute the spray. The small bucket and knapsack pumps do very well for a limited amount of spraying, but in field work, toys will not answer. All parts of the pump that are subject to wear should be of brass and should be carefully adjusted.

The Hose. Two pieces of one-half inch hose, of sufficient length to give freedom to the operator are needed. About fifteen feet is the length usually preferred.

The Nozzle. The nozzle is one of the most important parts of the spraying apparatus. It should throw a fine mist-like spray, and should be easily cleaned. The one in most common use is, perhaps, the Vermorel. The McGowen is one of the best for tall trees.

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*One-half pound hard soap, 1 gallon boiling water, 2 gallons kerosene. Dissolve the soap in the water, add the kerosene and churn through a force pump for ten minutes. For use, dilute ten to twenty times with water.

The Barrel. A kerosene barrel holding about fifty gallons, or a hogshead holding 100 gallons is the best tank. It can be placed upon the side or stood on end, and a small opening made in which to place the pump and to stir the liquid.

The Wagon. Any low wagon with wide tires is suitable. For convenience in turning, a two-wheeled cart is to be preferred.

WHERE MAY APPARATUS BE OBTAINED?

Pumps and nozzles are made by many reliable firms and may be obtained at comparatively low cost by ordering directly from the manufacturers. With so many good pumps on the market, it is not easy to state which is the best.

Of the prominent manufacturers of spraying apparatus, the following is a partial list: Morrill & Morley, Benton Harbor, Mich.; The Field Force Pump Company, Lockport, N. Y.; The Goulds Mfg. Co., Seneca Falls, N. Y.; The Deming Company, Salem, O. (Chas. J. Jager & Co., No. 174 High St., Boston, New England Agents); The Lenox Sprayer Co., Pittsfield, Mass.; F. E. Myers & Bro., Ashland, Ohio; W. & B. Douglass, Middletown, Conn.; The P. C. Lewis Company, Catskill, N. Y.; William Stahl, Quincy, Ill.; The Aspinwall Mfg. Co., Jackson, Mich. All these firms are reliable and will send catalogues on application.

The manufacturers of apparatus were requested to send to the Experiment Station a list of their agents in Maine. The following names were returned: Kendall & Whitney, Portland; C. M. Conant & Co., Bangor; R. B. Dunning & Co., Bangor; A. L. & E. F. Goss Co., Lewiston; George B. Haskell & Co., Lewiston; O. F. Frost, Monmouth; J. C. Crosby, Cranberry Isle; F. A. Hussey, Topsham; G. A. Perkins, Auburn; F. L. Howe, Fairfield; L. H. Strout, Kent's Hill; G. J. Riney, Gardiner.